



Docket No.: NIH-0127
Inventor: Mario H. Skidopoulos et al.
Title: ATTENUATED HUMAN-BOVINE CHIMERIC PARA-INFLUENZA VIRUS (PIV)
VACCINES Page 1 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 35

ACCAAAACAG AGAAGAGACT TGCTGGAA TATTAATCTA AAAAAAATT AACCTAGGAT 60
TAAAAGACCT TACCGAAAGG TAAGGGAAA GAAATCTAA GACTGTAAATC ATGTTGAGTC 120
TATTCGACAC ATTCACTCG CGTAGGCAGG AGAACATAAC GAAATCAGCT GTGTGGGCTG 180
TTATTCGGG GCAAAAAAAC ACTGTGTCTA TATTGCTCT TGACCACATCA AAACAGATG 240
ACAATGATAA AATGACATG GCTCTCTCT TTTTGTCTA TTCTTTAGAC ATGAAAAGC 300
AGCATGCCA AAGAGCTGGA TTTTTAGTT CTCTGTATC ATGGCTTATC GCCAAACCCAG 360
AATTATATT AACATCAAAAT GGAGTAAATG CAGATGT TAA ATATGTTATC TACATGATAG 420
AGAAAGACCC AGGAAGACAG AAATATGGTG GTTGTGCTG CAAGACTAGA GAGATGTTT 480
ATGAAAGAC AACTGATGG ATGTCGGGA GTGATCTTGA GTATGATCAA GACAATATG 540
TGCAAAATGG TAGAAGCACT TCTACAAATCG AGGATCTTGT TCATACCTTT GGATATCCAT 600
CGTGTCTGG AGCCCCATAA ATCCAGTTT GGATAATACT TGTTAGGCT ATAACCGATA 660
TATCAGGATT GAGGAAGGA TTCTTTACTC GTTGTAGAGC ATTCGACAA GATGGACAG 720
TTAAATCCAG TCTAGTGTG AGCGGTGATG CAGTAGAACAA AATTGGATCA ATTATGAGGT 780
CCCAACAGAG CTTGGTAAACA CTCATGGTT AACACTGAT AACATGAAC ACAGGCCAGGA 840
ATGATCTGAC AACAAATAGAA AAGAATATAC AGATGGTAGG AACTACATC AGAGATCAG 900
GTCTTGCTTC ATTTTGCAC AACATCAGAT AGGATCTTGA GACTAGATG GCAGCTCTAA 960
CTCTGCTCAC CCTTAGACCG GATATCAACA GACTCAAGG ACTGATCGAG TTATACTCAT 1020
CAAAGGGGCC AGCTGTCCT TTTATATGCA TTGGAGAGA TCCCGTGCAT GTGAGTTGG 1080
CACCAAGCAA CTATCCTGCC CTTGGAGATT ATGGATGGG TGAGCAGTT GTACAAAACA 1140
AGGCCATGCA ACAGTATGTA ACAGGAAGGT CTATCTGGA TATTGAAATG TTCCAACCTTG 1200
GTCAAGCAGT GGCACGTGAT GCGGAGTCGC AGATGAGTT AATATTAGAG GATGAACTGG 1260
GGGTACACACA AGAAGCAGAG CAAAGCTTGA AGAACACAT GAAGACATC AGCAGTTCA 1320
ATACAACCTT TCATAAGCCT ACAGGGGGAT CAGGGATAGA AATGGGGATA GATGAAAG 1380
CAAGGGCAGCC TGAATCCAGA GGAGATCAGG ATCAAGGGA TGAGCCTCGG TCATCCATAG 1440
TTCCCTATGC ATGGCAGAC GAAACGGGA ATGACATCAA AACTGAATCA ACTACAGAAA 1500
TTGACAGCAT CAAACTGAA CAAAGAAAACA TCAGAGACAG GCTGAAACAA AGACTCAGG 1560
AGAAAAGGAA ACAGAGTGC CCGAGATCAA CTGACATCAC AAACACACA AATCAACTG 1620
AAATAGATGA TTGTTCTAGT GCATTCGGAA GCAACTAGTC ACAAAAGAGAT GACCACTATC 1680
ACCAGCAACA AGTAAGAAAAA ACTTAGGATT AATGGAAATT ATCCAATCCA GAGACGGAG 1740
GACAAATCCA GAATCCAACC AACAATCAAT CAAACAAAGA TTCAATGGAAG ACAATGTTCA 1800
AAACAAATCAA ATCATGGATT TTGGGAAGA GGGATCAAGA GATAAAATCAT CTGACATTC 1860
ATCGGCCCTC GACATCATGG AATTCACTACT CAGCACCAGC TCCCAGAAAA ACACGGCAGA 1920
CAGCAATGAA ATCAACACAG GAACCCAAAG ACTAGCAGG ACAATCTACC AACCTGAAATC 1980
CAAACAAACA GAAACAAAGA AGGAAATAG TGGAACAGCT AACAAAATC GACAGTTGG 2040
GGCATCACAC GAAACGTGCCA CAGAGACAAA AGATAGAAAT GTTAATCAGG AGACTGTACA 2100
GGGAGGATAT AGGAGGAGGA GCAGGCCAGA TAGTAGAACT GAGACTATGG TC ACTCGAG 2160
AATTCAGCA AGCAGGCCAG ATCTAAACAA TGGAACCCAA ATCCAGGAAG ATATTGATTA 2220
CAATGAAGTT GGAGAGATGG ATAAGGACTC TACTAAGAGG GAAATGCGAC AATTTAAAGA 2280
TGTTCCAGTC AAGGTATCAG GAAAGTGTATGC CATTCTCCA AACAAAACAG ATGGAGACGG 2340
TGATGATGGA 2350

FIGURE 1A



SEQ ID NO: 35

AGAGGCCCTGG AATCTATCAG TACATTGAT TCAGGATATA CCGATATAGT GACTGCCGCA 2410
 ACACATAGATG ACGAAGAAGA ACTCTTTAG AAGAACAAACA GGCCAGAAA GTATCAATCA 2470
 ACACCCAGA ACAGTGACAAA GGAATTAAA AAAGGGGTT GAAGGCCAAA AGACACAGAC 2530
 AAACAATCAT CAATTTGGG CTACGAACTC AACTCTAAAG GATCGAAGAA GAGCCAGAAA 2590
 ATCCCTAAAG CGACGACGAA TACAGGAGAA CCAACAA GAC CACAGAATGG ATCCCAGGGG 2650
 AAGAGAATCA CATCCTGGAA CATCCTCAAC AGCGAGAGCG GCAATCGAC AGAAATCAACA 2710
 AACCCAAACCC ATCACAGACATC AACCTGGGGAA CAGAACCCACA CAATGGGACC AAGCAGAAC 2770
 ACCTCCGAAC CAAGGATCAC GACACAAAAG ACGGATGGAA AGGAAAGAGA GGACACAGAA 2830
 GAGAGCACTC GATTACAGA AAGGGGATT ACATATTAC AGAATCTGG TTGATTCGA 2890
 TCTCAGCAA AATTAGACCT ATACAGAAC AGAGAGTTG TTGTTGTGCG GAATGTCCTA 2950
 AACAAATGCAG ATACTGCATC AAAGATAGAC TTCTCTAGCG TTGTTGATGAT AGGAGTGTCA 3010
 ATGGATCATG ATACCAAATT AAATCAGATT CAGAACGAGA TATTAAGTTT GAAAATCTGAT 3070
 CTTAAAAAGA TGGATGAATC ACATAGAAGA CTATTTGAGA ATCAAAGAAGA ACAATTATCA 3130
 CTGATCACAT CTTAACTTC AATACTTAA ATTATGACAG AGAGAGGAGG GAAGAAGGAC 3190
 CAACCGAAC CTAGCGGGAG GACATCTTCAT ATCAAGACAA AGACAAAAGA AGAGAAAATA 3250
 AAGAAAATCA GGTTTGACCC TCTTATGGAA ACACAGGCA TCGAGAAAAA CATCCCTGAC 3310
 CTCTATAGAT CAATAGAGAA AACACCAGAA AACGACACAC AGATCAATC AGAAAATAAAC 3370
 AGATTTAATG ATGAATCCAA TGCCACTAGA TTAGTACCTA GAAGAATAG CAGTACATG 3430
 AGATCATTAA TAATACTCAT CAAACACAG AATTATCAT CAAAAGCAAC GCAATCATAC 3490
 ATCAACGAAC CTAGCTCTG CAAGAGTGAC GAGGAAGTGT CTGAGTTGAT GGACATGTTC 3550
 ATAGGAGATG TCAGCTCCCCA GTAAAGCCGC AACCAAGGGT CAACACCAAG AAAACCAATA 3610
 GCACAAAACA GCCAATCAGA GACCACCCCA ATACACCAA CCAATCAACA CATAACAAAG 3670
 ATCTCCAGAT CATAGATGAT TAAGAAAAC TTAGGATGAA AGGACTAATC AATCTCCGA 3730
 AACAAATGAGC ATCACCAACT CCACAACTCA CACATCCCCA GAATCTCTT TCTCCGAGAA 3790
 TGGCAACACATA GAGCCGTTAC CTCACGATT CAATGAAAG CAG AGAAAAGGCCA TACCTCATAT 3850
 TAGGGTTGTC AGAGTAGGAG ATCCGGCCCAA ACATGGATTC AGATATCTGG ATGTTTTTT 3910
 ACTGGGCTTC TTAGGATGAG AAAGTCAA AGACAGGATG GGGGACATAA GTGATCTAGA 3970
 TGATGATCCA AGTTACAAGG TTGTTGGCTC TGATCATG CCACCTGGGT TGGCTAGATA 4030
 CACCGGAATG GATCAAGAAC TCCTACAGGC TGCAACCAAG CTGATATAG AAGTAAGAAG 4090
 AACTGTAAAGG GCTACGGGAGA TGATAGTTT CACTTGACAA AACATCAACAC CTGAACTATA 4150
 TCCATGGTCC AGTAGATTTAA GAAAAGGGAT GTTATTTGAC GCTAATAAGG TTGCACTTGC 4210
 TCCTCAATGT CTTCACCTAG ATAGAGGGAT AAAATTCAAGG GTGATATTG TGAACTGCAAC 4270
 AGCAATTGGG TCAATAACTC TATTCACAA CCTTAAGTC ATGGCATTTG TATCATGGC 4330
 TAATACAATA TCAATAAAATC TACAAGTACA TATCAAAACA GGAGTTCAGA CAGATTCAC 4390
 AGGAGTAGTT CAGATTCTAG ATGAAAAGG TGAAAATCA CTAATTTCA TGTTTCACT 4450
 CGGGTTGATC AAAAGGAGA TGGGCAGAAT GTACTCGTT GAATATTGTA AGCAGAAGAT 4510
 CGAGAAGAGT AGATTTATAT TCTCATTTGGG ATTAGTGGG GGGATCAGCT TCCACGTCAA 4570
 CGCAACTGGC TCTATATCAA AGACATTAGC AAGTCAAATTA GCATTCACAAAGAATCTG 4630
 CTATCCCTA ATGGATCTGA ATCCACACTT AAATTCAGTT ATATGGCAT CATCAGTTGA 4690
 AATTACAAGG 4700

FIGURE 1B



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VACCINES Page 3 of 27
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GTGATGCGC TTCTCAGCC TTCAATTACCTT GGCGAATTCA GATACTACCC AAACATCTAA 4760
GCAAAAGGGG TCGGGAAAAT CAGACAGTAA AATCAACAC CCTGATATCC AACATTTGCAA 4820
ATCAGGCTAC CCACAGGAGA AAAATCAAAA ACTTAGGATC AAAGGGATCA CCACGAACCC 4880
CGAAAAACAG CCAACAAAC CAACACACAA ATCACAGACA AAAAGGAGAA GGCACTGCAA 4940
AGACCGAGAA AAAACAGAAC GCACACAACC AAGCAGAGAA AAGCCAAGC CGGCCATTCA 5000
CAAACACACC AACAATCTG CAAACAAGCA CCAAAACAGA GGTCAAAGA CAAAGAGCAC 5060
CAGATATGAC CATCACAAAC ACAATCATAG CCATATTACT AATACCCCCA TCATTTTGTC 5120
AAATAGACAT AACAACACTG CAACGTGTAG GTGTTGTTAG CAAACATCTT AAAGGCATGA 5180
AGATTTGCAAA ATTTGCGAA AGAGATACCC TGATATTAAG TTGATACCC AAAATAGAGA 5240
ATTGACACTC ATGTTGGGAT CAAAGATATA ACCAATACAA GAACTTATTG GATAGATGA 5300
TAATTCCTCT ATATGATGGA TTTAAATTAC AAAAGAGTGT AATAGTAGTA AGTCATGAA 5360
CCCACAACAA TACTAACTT AGGACAAAC GATTCTTGG AGAGATAATT GGACATTG 5420
CGATAGGGAT AGCCACTTCA GCACAAATCA CGCAGCAGT CGCTCTGTC GAAGCTAAAC 5480
AGGCAAAAGTC AGACATAGAA AACTCAAG AGGCTTAAAG AGACACAAAC AAGGCACTAC 5540
AATCGATTCA AAGTTCTGTA GTAAACCTAA TTGTTGCACT TAATCAGTT CAAGACTATG 5600
TCAACAATCA AATTATACTT TCAATCACAA GATTAGGCTG TGAAGCAGCA GGTTTACAAAT 5660
TGGAAATTGC ATTGACACAA CATTACTCG AATTAACCAA TATATTGTTG GATAATTAG 5720
GAACACTGAA AGAAAGGGG ATAATTTAC AGGGATAGC ATCATTATAT CACACAAACA 5780
TAACGGAAAT ATTACTACT TCAACAGTT ACCAATATGAA TATTATGAC CTATTATCA 5840
CTGAGTCATT CAAGATGAGA GTGATGATG TTGATTGG AGTACTCTCA ATTACTCTTC 5900
AAGTTAGACT TCTCTTATTA ACTAAACTAT CAAACTACTA AATTATAAA GTAGATTCTA 5960
TATCATAACAA CATCCAGGGC AAAGAGTGGT ATATTCCTCT TCCCAATCAC ATCATGACAA 6020
AAGGGCTTT TCTAGGTGGT GCTGTATTTA AAGAATGCA AGAGGCATTC AGCAGTTATA 6080
TATGTCCTTC TGATCCAGGT TACATTTAA ATCACAGAAT AGAGAATTGT TTATCAGGG 6140
ACATAACACAA GTGCTCTTAAG ACTGTTGTTA CATCAGATGT GGTACCCACGA TAGCGTTTG 6200
TGAATGGTGG ATTAATTTGCA AACTGCATAA CAACTACATG TACATGCAAT GGAATTGACA 6260
ATAGAATTAA TCAATCACCT GATCAAGGAA TTAAGATCAT AACACATAAA GAATGCCAGG 6320
TAATAGGTAT AAACGGAAATG TTATTCATAA CTAATAGAGA AGGGACATTA GCAACTTATA 6380
CATTTGTGAA CATCATATTA AATAACTCTG TTGCACTTAA TCCAATTGAT ATATCTATGG 6440
AACTCAACAA GGCAAAACTA GAATTAGAAG AATCGAAGGA ATGGATAAAG AAATCAACATC 6500
AAAAGTTAGA TTCCGGTGGG AGTTGGTATC AACTCTGTC AACATCACC AATATCATG 6560
TGATGATAAT AATTCTAGTT ATAATCAATA TAACATAT TGTAGTCATC ATCAAATTCC 6620
ATAGAATTCA GGGAAAGAT CAAACAGACA AAAACAGTGA GCCGTATATA CTGACAAATA 6680
GACAATAAGA CTATACACGA TCAAAATATAA AAAGTACAAA AAACTTAGGA ACAAAATGTT 6740
TCAACACAGC AGCACCGAAAG AGACACAAAG GCAGCGCAGA GGGCACCAAC AACTCAAA 6800
TGGAAATTGTT GAAACACACA AACAGCATAA ATAACACAA CAATGAAACC GAAACAGCCA 6860
GAGGCAAAACA TAGTAGCAAG GTTACAATAA TCATAATGTA CACCTCTGG ACAATAACAT 6920
TAACAAATATT ATCAGTCATT TTATTAATGAA TATTGACAAA CTTAATTCAA GAGAAATC 6980
ATAATAAATT AATGTTGCAAG GAAATAAGAA AAGAATTCCG GGCAATAGAC ACCAAGATTG 7040
AGAGGACTTC 7050

FIGURE 1C



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VACCINES Page 4 of 27
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GGATGACATT GGAACTCTAA TACAGTCAGG AATAAATACA AGACTTCTCA CAATT CAGAG 7110
TCATGTTCAA AAATCATTC CACTATCCT AACACAAACAA ATGTCTGAGTC TCAGAAAATT 7170
TATCAATGAT CTAAACAAATA AAAGGAAACA TCAAGGAAGT CCAATACAGA GAATGACTCA 7230
TGATAGAGGT ATAGAACCCCC TAATCCAAA CAAGTTCTGG AGGTGTCACAT CTGGTAACCC 7290
ATCTCTAACCA AGTAGTCCTA AGATAAGGGT AATACCAAGGA CCAGGTTTAT TAGCAACATC 7350
TACTACAGTA ATAGGCTGTA TTAGAATTCC ATCGTTAGTA ATCAATCATC TAATCTATGC 7410
TTACACCTCT AAATCTTATA CCCAGGGCTG TCAAGGATA GGGAAATCTT ACCAAGTACT 7470
ACAATAATGGG ATAAATTCTTA TAATTCGGG CCTAGTACCT GATTTAAACCC CCAGAGTCAC 7530
ACATACATT TAAATTGATG ATATAAGGAAG ATCTGGCTCT CTGGCACTAT TGAATACAGA 7590
TGTTTATCAG TTATGCTCAA CACCAAAGGT TGATGAAAGA TCCGATTATG CATCAACAGG 7650
TATTGAGGAT ATTGACTTG ACATTTGTCAC TAATAATTGGA TTAAATTATAA CAACAAGGGT 7710
TACAAAATAA ATATAAACTT TTGATAAAACCG GTATGCCGCA TTGTATCCAT CAGTGGACCC 7770
AGGAATCTAT TATAAGGATA AAGTTATATT TCTCGGATAT GGAGGTTCTAG AGCATGAAGA 7830
AAACGGGAGC GTAATATGTA ATACAACCTGG TTGCTCTGGC AAAACACAGA GAGACTGTAA 7890
TCAGGCTCTC TATAAGCCCAT GGTCTCAA TAGGAGAATG GTAAACCTTA TTATTTGTTG 7950
TGATAAAAGGC ATAGATGCCA CTTTTAGCTT GAGGGTGTGG ACTATTCCCA TGAGCCAAA 8010
TTATTTGGGAA TGAGAAGGAA GATTACTTTT ATTAGGTGAC AGATAATACA TTATATCTAG 8070
ATCCCAAGT TTGCAACAGTA AATTACAGTT AGGGGTTATT GATATTCTG ATTATACATAA 8130
TATAAGAATA AATTGGACTT GGCAATAATGT ACTATCACGG CCAGGGAAATG ATGAATGTCC 8190
ATGGGGTCTAT TCATGCCAG ACAGGATGT AACAGGAGTT TACACTGATG CATATCCGCT 8250
AAACCCATCG GGAGGTGTTG TATCATCAGT AATTCTTGAT TCACAAAAGT CTAGAGAAAA 8310
CCCAATCATT ACTTACTCAA CAGCTACAAA TAGAATAATAGA TTGATGCTA TATATAACAG 8370
AACACTTCCA GTGCTCATCA CAAACACAAA TTGTATCACA CATTATGATA AAGGGTATTG 8430
TTTCTATATA TGAGAATAAA ATCACAGAGG TTGAAATAGG TTCAACCTA TTGTTATCCTA 8490
AACAGAGGT CCAAAAAGT CGAGCTAAAT TGATCATCGG ATATCGATG CAAGATGACA 8550
TTAAAAGAGA CCACCAAGACA GACAACACAG GAGACGATGC AAGATATAAA GAAATAATAA 8610
AAAACCTAG AGAAAAGTGT GCAAGAAAAA TTGGACACCGA GTCCCCACAGC GGCACAACT 8670
CTGACATTCT GTACCCCTGAA TGTCACTCTA ATTCTCCATT AGTTAAAGGA AAGATAGCAC 8730
AACTGCATAC AATAATGAGT TTGCTCTCAGC CCTAGGATAT GGATGATGAT TCAATACTG 8790
TTATTACTAG ACAAACAAAATT AAACCTAATAA AATTAGATAA AGACAAACGG TCATATTAGGA 8850
AATTAAGGATC AGTCCTTAATAA TTGATGCTAGG TTGATCTAGG TTATATACCC TTATCAGAT 8910
ATCCAGAGAT GTCTAGTGAAT ATGTTCCAAAT TATGATPACCG CGGAATTAAAT AAAAAATAA 8970
ATGAATTGCT AGTAAAGCA AGTAAACAT ATAATCAAAT GACTGATGGA TTAAGAGATC 9030
TATGGGGTAC TATACTATCG AAGTTAGCAT CGAAAATGAG TGGAAAGTAAT TATGATATCA 9090
ATGAACATAT TAGCAATATA TCAAATGTC ACATGACTTA TCAATCAGAC AAATGTATA 9150
ATCCCAATTCAA GACATGGTTT ACTTAAAGT ATGACATGAG AAGATTACAA AAAGCCAAA 9210
ATGAGGATAC TAAATCATTAGG CATAAAGGAT ATAATACATG AGAAGGACCA AAGAATATAT 9270
TGCTGTATACA TCCAGAACCTC GTCTAAATATAGATAAACA AATAACAAAT GGGTATATAA 9330
TGACTCTGAA ATTGGTACTA ATGTTATGTG ATGTTAGTGA AGGGAGGTGG AATATAAGTT 9390
CATGTGCAAA 9400

FIGURE 1D



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VACCINES Page 5 of 27
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ATGGGATCTT AAGTTACAT CAATGTATTAA TAAAGGTTAAC AATTATGGG AAATAATAGA 9460
TGGACTATTC TCACCTTAG GAGAAAAGC ATTTGACATA ATATCACTAT TAGAACCACT 9520
TGCATTATCG CTCATTCAA CTTATGACCC GTTAAACAG CTCAGGGGG CTTTTTTAAA 9580
TCACGTGTTA TCAGAAATTG AATTAATATT TGCAGCTGAG TGTACAACAG AGGAATAC 9640
TAATGTGGAT TATATAGATA AAATTAGA TGTGTTCAA GAATACAACAA TAGATGAAAT 9700
AGCAGAAAATT TTCTCTTCTC TCCGAACTTT TGACACCT CCATTAGGG CGAGTATAGC 9760
AGCAGAGATA GTTAAAGGT ATATGATACAT TGAGAAATGC TTGAATTTG ATACTATCAA 9820
TAAATGTCAT GCTATTTTGTACATAAT TAAATAAGGAA TATAGAGAAA GACATGGTG 9880
TCAATGGCTT CCAGTACAT TACCTGTCGA TGCCACAT GAA TTTATCATAA ATGCCATACGG 9940
ATCAAAATTCTT GCACATCAT ATGAGAACATG TGAGAT TATAAGAGCT TCATAGGAAT 10000
AAAAATTGAC AAGTTTATAG AGCCTCAATT GGATGAGAGC TTAACTATT ATATGAAAGA 10060
TAAAGCCTTA TCCCCAAAGA AATCAACACTG GGACACAGTC TATCCAGCTT CAAACCTGTT 10120
ATACCGCCT ATGATGTCTC ATGATTCACG AAGATTGTT GGAGTATTAA TAGCAAGATG 10180
TAAATTGAT CCCACCAAG TATAGATTA TGCTAGAA TCA GGATATTGGC TGGATGATCC 10240
TGAATTAAAT ATCTCATATA GTTAAAAGA GAAAGAAATA AAACAAAGAG GTAGACTTTT 10300
TGCAAAAATG ACATACAAGA TGAGGGCTAC ACAAGTTATA TCAGAACAT TATIGGCAG 10360
TAATATAGGG AAATTCTTC AAGAGAAATGG GATGGTTAA GGAGAAATTG AATTACTCAA 10420
GAGACTAAC ACAAATCTA TGCTGGAGT TCCGGGTAT AATGGAGGTAT ACAATAATTC 10480
AAAAAGTCAC AACAGAAGAAC TTCAGCTTA TAATGCAATT AGCAGTCTCA ATTATCTTC 10540
TAATCAGAAAG TCAAGAAAGT TTGAATTAAAT ATCTACAGAT ATACATAATG ATGGATACGA 10600
AACCCTGAAAGC TGCTCTTAA CGACAGACTT AAAAATTAT GTTTAAATT GGAGGTATGA 10660
ATCAACAGCT TTATCGGTG ATACTGTAA TCAGATATTGGGTTAAAGG AATTATTTAA 10720
TTGGCTGCAC CCTCGCTTG AAAAGAGTAC AATATATGTT GGAGATCCTT ATTGCCCGCC 10780
ATCAGATATT GAACATTTCAC CACTGTGTA CCATCTTGT TCAGGATTTC ATGTTCTATAA 10840
TCTCTAAAGGA GAAATAGAAGG GTTGTGCCA AAAGTTATGG ACACCTCATAT CTACAGTGC 10900
AATACATTTA GCAGCTGTCA AAATCGGTGT AAAGGTACT GCAATGGTC AAGGGGATAA 10960
TCAAGCCATA CGCTTACCA CAAGAGTACCA TAATATTGAT GATTATAAG TTAAGAAAAG 11020
GATTGTTTA AAAGATGTGG TAAGATTTC TGATTCCTG AGAGAGGTGA TGGATGATCT 11080
GGGTCTGAG CTCAAACATAA ATGAAACTAT AATAAGTGT AAAATGTTA TATATAGCAA 11140
AAGGGATATC ATGACGGAA GAATCCCTTC TCAGGCATTA AAAGCATTTGT CTAGATGTGT 11200
TTTTGGCTT GAAACATCA TAGATGAGAC AAAGATCAGCA TCCCTCAAATC TGGCTACATC 11260
GTTGCAAGG GCACTGTGAGA ATGGCTACTC ACCTGTATTG GGATATGTAT GCTCAATCTT 11320
AAAAATATC CAACAGTTG ATATAGCGT TGAAATGAT AATAACCCAA CTATAACCCAA 11380
AAATATTTAA GATCAATT TCAGGAATAT TCATGGATG CAATATGCC CTAAATCCC 11440
TGCTAGTGTGTC GGAGGTTTA ATTATATGGC CATGTCAGG TGTTTGTCGA GAAACATTGG 11500
AGATCCCTACA GTGCCCTGCGT TAGCCGATTA TAAAAGATT AAAAAAGCAA ATTTGTTAGA 11560
TCGAGGTGTC CTTACAGAAA TTATGATCA AGAAGAACGGC GAGTCTCTT TTTAGACTG 11620
GGCTCTGAGAT CCCTTATCAT GTAACTTACCA ACATCTCAA AATATAACCA CCATGATAAA 11680
GAATATAACT GCAAGAAAATG TACTACAGGA CTACCAACAC CCATTACTAT CTGGATTATT 11740
TACAAGTACA 11750

FIGURE 1E

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VACCINES Page 6 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001



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ATGATAGAAG AGGATGAGGA ATTAGCTGAG TTCTCAA TGG ACAGGAGAAAT AATCCCTCCA 11810
AGAGTTGCAC ATGACATTG AGATAATTCT CTTACTGGA TTAGGAATGC TATAGCTGGT 11870
ATGTTGGATA CAACAAAATC ACTAATTCGA GTAGGATAA GCAGAGGAGG ATTAA CCTAT 11930
AACTTAAAGA GAAAGATAAG CAACTATGAT CTTGTAACAAT ATGAGACACT TAGTAAACT 11990
TTAAGACTAA TAGTCAGTGA CAAGATTAAG TATGAAGATA TGTCCTCAGT AGACCTAGCC 12050
ATATCATTAA GACAAAAAAT GTGGATGCA TTACAGGAG GAAGAATGAT AAATGGACTT 12110
GAAACTCCAG ATCCCTTAAAG GTTACTGTCT GGAGTAAATAA TAACAGGATC TGAAACATTG 12170
AGGATATGTT ATTCAACTGA AGGTGAAAGC CCATATACAT GGATGTTTT ACCAGGCAAT 12230
CTTAATATAG GATCAGCTGA GACAGGAATAA GCATCATTAAG GGTTCCCTTA CTTGGATCA 12290
GTTCAGATG AGAGATCTGA AGCACAAATTA GGTGATATCA AAATCTAG CAACACCAGT 12350
AAGGCTCTCA TAAGAATAGC AATGATATATC ACTGGGGCAT TTGGGAATGA CGAAATATCT 12410
TGGATGGAAG CATCACAGAT TGCAACAAACCA CGTGCACAAACT TTACATTGGA TAGCTTAAG 12470
ATTTGACAC CAGTGAACAC ATCAACAAAT CTATCACACAA GGTTAAAGA TACTGCTACT 12530
CAGATGAAAT TTCTTAGTAC ACTACTTAAAG AGATGAA GCA GTTTCATCAC AATATCTAA 12590
GATAATATGT CTATTAAGA AGCAATGAA ACTAAAGATA CAATCTTAT TTATCAACAG 12650
GTAATGTTAA CAGGATTAAG TGTATTGAA TATCTATTTA GTTGTAGGAG GAGTACAGGA 12710
CTAAACCCCTA TGGTCATGCA TCTACATATA GAGGATGGAT GTTGTATAAA AGAGAGTTAC 12770
AATGATGAGC ATATCAATCC GGAGTCTACA TTAGATTTAA TCAATACCC TGAGAGATAAT 12830
GAATTATATAT ATGATAAGGA CCCTTTAAAG GATATGATC TATCAAATT AATGGTTATA 12890
AGAGATCATT CTTATACAAAT TGACATGAT TACTGGGATG ACACAGATAT TGACATGCA 12950
ATATCAATAT GTACTGCGT TACAAATAGC GATACAA TGT CGCACTAGA TCAGGGATAAT 13010
CTTAAGGAGC TGGTTGATG TGCAAAATGAT GATGATTTA ACAGCTGTAT AACTGAA TTT 13070
CTGACCCCTAG ATATACAGT GTTCTCTAAAC ACATTTGGAG GTTACTCTGT GAATCAATT 13130
GCATATACCC TTATGTTTAAAG GAAAGATGAA GGAAAGGGATC CCATTGGGA TTATAATG 13190
AGAACATTA AAGACACCTC ACATTCAGTA CTTAAAGTAT TATCTAATGC ACTATCTCAT 13250
CCAAAAGTGT TTAAGAGATT TTGGGATTGT GGAGTTTGA ATCTTATTTA TGTCCTAAT 13310
ACTGCTAGTC AAGATCAAGT TAAGCTTGTCT CTCCTCGA TTT GCGAGTACTC CTGGATCTA 13370
TTTATGAGAG AATGGGTGAA TGGAGCATCA CTTGAGATCT ATATCTGTGA TAGTGACATG 13430
GAAATAGCAA ATGACAGAAAG ACAAGCATT CTCTCAAGAC ATCTTGCCTT TGTTGTTGT 13490
TTAGCAGAGA TAGCATCTT TTGACCAAAAT TTATTAATC TAACTATCTT AGAGAGACTT 13550
GATGAATTAA AACAATACCTT AGATCTGAAC ACAAAAGGAA ATCTTACTCTT TAAATATGTG 13610
CAAGTATCAG GACTGTAAAT TAAATCATTC CCCTCAACTG TTACGTATGT AAGGAAACT 13670
GGGATTAAAG ATCTGAGGAT TGTTGTTATT AATCCGGCTG AAACGATTGA AGATTGGAT 13730
CCCCATAGAAG ATGAGAAAT CTTAGACAAAT ATTGTTAAA CTGTTAAATGA CAATTGGCAGT 13790
GATAATCAAAG AGAGAAATAA AAGTAGTTT TTCTGGGGAT TAGCTCTAA GAATTATCAA 13850
GTCGTGAAAGA TAAGATCCAT AACGAGTGTAT CTGTAAGTTA ATGAAGCTTC GAATGTTACT 13910
ACACATGGAA TGACACTTCC TCAGGGAGGA AGTTATCTAT CACATCAGCT GAGGT TATT 13970
GGAGTAAACA GTACAAGTTG TCTTAAAGCT CTTGAATTAT CACAAATCTT AATGAGGGAA 14030
GTTAAAAAAG ATAAGATAG ACCTCTTTTA GGAGAAGGAG CAGGAGCTAT GTTAGCATGT 14090
TATGATGCTA 14100

FIGURE 1F

Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 7 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001



SEQ ID NO: 35

CACTCGGGTCC TGCATAATT CTGGTTAAA TATTACAGAT GTAAAT TGGTC	14160
AACCGGAATT AAAAATCTT CCATCAGAG TATCATTAGT AGGTAAAAAA CTAGGAAATG	14220
TAACACAGAT CCTTAATCG GTGAGGGGTG TATTAAATGG GAATCCCAAT TCAACATGGA	14280
TAGGAAATAT GGAAATGTGAG AGTTAATAT GGAGTGAAAT AAATGATAAG TCAATTGGTT	14340
TAGTACATTG TGACATGGG GGAGCGATAG GCACATCAGA AGAAAATGTT CTACATGAC	14400
ATTATAGTAT TATTAGGATT ACATATTTAA TCGGGGATGA TGATGTTGTC CTAGTATCAA	14460
AAATTATACCA AACTTACTT CCGAATTGGT CTAAAATCT ACTATCTATAC AAGTTGTATT	14520
CGGAAGGATCT AGGTGTAGTG TCCCCAAAAA CATCCAACTC TGCCCTCAACAGAGCTTTATT	14580
TAATTCAAA AGATGCTTAC TGTACTGTAA TGGAACCCAG TAATCTTGT TTATCAAAAC	14640
TTAAAAGGAT ATCATCAATA GAAGAAAATA ATCTTAAATGTTGATAATC TTATCAAAAAA	14700
CGGAAGAATAA CGAGTGGTTA CAGCATGAAA TCAAGAAGG AGAAAGGGAT TATGGGATAA	14760
TGAGGCCATA TCATACAGCA CTGCAAAATT TTGGATTCCA AATTAACCTTA AATCACTTAG	14820
CTAGAGAATT TTATCAACT CCTGATTTAA CCAACATTA TAATATAAA CAAAGTTTTA	14880
CAAGAACAAAT TAAAGATGTT ATGTCGAAT GGGTCAATAT CACTCATGAC AATAAAAGAC	14940
ATAAAATTAGG AGGAAGATATA AATCTTACCC CGCTTAAAAA TAAGGGGAAAT TTAAGGATTAT	15000
TATCACGAAG ATTAGTACTA AGCTGGATAT CATTATCCTT ATCAACCGAG TTACTGACGG	15060
GCCGTTTTCC AGATGAAAAA TTGAAAATA GGGCACAGAC CGGATATGTA TCATTGGCTG	15120
ATATTGATT AGAACTCTTA AAGTTTAT CAAGAAATAT TGTCAAAAT TACAAGAAC	15180
ACATAGGATT AATATCATA TGTTTTGAA CCAAGAGGT CAAAATACTA ATGAAAGCTTA	15240
TAGGAGGAGT CAAACTACTA GGAATTCCCA AACAGTACAA AGAGTTAGAG GATCGATCAT	15300
CTCAGGGTTA TGAATATGAT AATGAATTG ATATTTGTTA ATACATAAAA ACATAAAATA	15360
AAACACCTAT TCTCTACCCA TTCACCTCCA ACAAAATGAA AGTAAGAAA AACATGTAAT	15420
ATATATATAC CAAACAGAT TTTTCTCTTG TTGGT	15456

FIGURE 1G



Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARA-INFLUENZA VIRUS (PIV)
VACCINES Page 8 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

ACCAACAAAG AGAAGAGACT TGCTTGGGAA TATTAATTCA AATAAAAATT AACCTAGGAT	60
TAAGAACACTT TACCGGAAAGG TAAGGGGAAAG GAAATCTAA GACTGTAAATC ATGTTGAGTC	120
TATTGGACAC ATTCACTGGC CGTAGGCAGG AGAACATAAC GAAATCAGCT GGTTGGGGCTG	180
TTATTCCCGG GCAAAAAAAC ACTGTGTCTA TTTTGCTCT TGAGGACATCA ATAACAGATG	240
ACAATGATAA AATGACATG GCTCTCTCTC TTTGGCTCA TTCTTTAGAC AATGA AAAGC	300
AGCATGGCGA AAGAGCTGGA TTTTAGTTT CTCTGTATC AATGGCTTATGCCAA CCCAG	360
AATTATATT AACATCAAAT GGTAGTAATG CAGATGTTAA ATATGTTATC TACATGATAG	420
AGAAAAGACCC AGGAAAGACAG AAATATGGT GGTTTGTCTG CAAGACTAGA GAGATGGTTT	480
ATGAAAAGAC ACTGTGATGG ATGTTGGGA GTGATCTGA GTATGATCAA GACAA TATGT	540
TGCAAAATGG TAGAACACT TCTACATCG AGGATCTGTG TCATACATTT GGATA TCCAT	600
CGTTGCTCTG AGCCCTTATA ATCCAAGTTT GGATAAAACT TGTTAAGGCT ATAACCAAGTA	660
TATCAGGATT GAGGAAAGG TTCTTTACTC GGTAGAAAGC ATTTGACACA GATGG AACAG	720
TTAAATTCAG TCTAGTGTG ACCTGGGTGATC CAGTAGAAACA AATTGGATCA ATTAT GAGGT	780
CCCAACAGAG CTTGGTAACA CTACATGGTTG AAACACTGAT AACAATGAAC ACAGG CAGGA	840
ATGATCTGAC AACAAATAGAA AAGAATATAC AGATTTGAG AAACATACATC AGAGA TCGAG	900
GTCCTGGCTC ATTTTCAAC AACAATCAGAT ATGGCATATGA GACTGAAATG GCAGC TCTAA	960
CTCTGTCTAC CCTTAGACCC GATTAACAA GACTCAAGGC ACTGATCGAG TTATA TCTAT	1020
CAAAAGGGCCC ACCTGCTCTT TTATATGCA TTTTGAGAGA TCCCGGTGCAAT GGTTGAGTTG	1080
CACCAAGGCA CTATCCTGCC CTCTGGAGTT ATGCGATGGG TGTTAGCAGTT GTACA AAAACA	1140
AGGCCATGCA ACAGTATGTA ACAGGAAGGT CTTATCTGGA TATTGAAATG TTCCA ACTTG	1200
GTCAAGCGT GGCACGTGAT GCGCAGTCGC AGATGAGTT AATATTAGAG GATGAACCTGG	1260
GGGTCAACAC AGAAGCCAG CAAAGCTTGA AGAAAACATC AGAAACACATC AGCAG TTTCAG	1320
ATACAACCTT CTATAAGCTC ACTAGGGGGAT CAGCCATAGA AATGGCGTAA GATGAAGAAG	1380
CAGGGCAGCC TGAATCCAGA GGAGATCAGG ATCAAGGAGA TGAGCCTCGG TCATC CATAG	1440
TTCTTCTATGC ATGGGCAAGA GAAACCCGGG ATGACAATCA AACTGAATCA ACTACAGAAA	1500
TTGACAGCAT CAAAATCTGA CAAAGAAACA TCAGAGACAG GCTGAACAAA AGACT CAACG	1560
AGAAAAGGAA ACAGACTGAC CCGAGATCAA CTGACATCAC AACAACACAA AATCAAACCTG	1620
AAATAGATGA TTGTTCTAGT GCATTCGGAA GCAACTAGTC ACAAAGAGAT GACCAACTATC	1680
ACCAGCAACA AGTAAGAAAAA ACTTAGGATT ATGGAAAAT ATCCAATCCA GAGAC GGAAG	1740
GACAATCTCA GAATCCAAAC ACAACTCTAT CAACTTAAAGA TTCTGGAG ACATGTCTCA	1800
AAACAATCAA ATCATGGATT CTGGGGAAA GGGATCAGGA GATAAAATCAT CTGAC ATCTC	1860
ATGGCCCTC GACATCATG AATTCTACG CAGCACCCGAC TCCCAAGAAA ACACGGCAGA	1920
CAGCAATGAA ATCAACACAG GAACCCAAAG ACTTAGCAGC ACAATCTACC AACCTGAATC	1980
CAAAACAAAC GAAACAAGCA AGGAAAATAG TGGACCAAGCT AACAACAAATC GACAG TTGG	2040
GGCATCACAC GAACCTGGCA CAGAGACAAA AGATAGAAAT GTTAATCAGG AGACTGTAC	2100
GGGAGGATAT AGGAGAGGAA GCAGCCCCAGA TAGTAGAACT GAGACTATGG TCACT CGAAG	2160
AATCTCCAGA AGCAGCCCG ATCTCAACAA TGGAAACCCAA ATCCAGGAAG ATATT GATTA	2220
CAATGAAGTGG GGAGAGATGG ATAAAGGACTC TACTAAGAGG GAAATGGCAC AATTTAAAGA	2280
TGTTCCAGTC AAGGTATCAG GAAGTGTAGC CATTCTCTCA ACAAAACAAAG ATGGGAGACG	2340
GTATGATGGA	2350

FIGURE 2A



Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 9 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

AGAGGGCTGG AATCTTACAG TACATTGAT TCAGGATATA CCAGTATAGT GACTGCCA 2410
ACACTAGATG ACGAAGAAGA ACTCCTTATG AAGAACAAAC GGCAGAAA GTACTAATCA 2470
ACACCCAGA ACAGTGACAA GGAATTAAA AAAGGGTTG GAAGGCCAA AGACAGAC 2530
AAACAATCAT CAATATTGGA CTACGAACTC AACCTCAAG GATCGAAGAA GAGCCAGAAA 2590
ATCCCTAAAG CCAGCAGCAA TACAGGAGAA CCAACAAAGC CACAGAAATGG ATCCCTAGGG 2650
AAGAGAATCA CATCCTGGAA CATCCTCAAC AGCGAGAGCG GCAATCGAAC AGAAATCAACA 2710
AACCACACCC ATCAGACATC AACCTCGGGAA CAGAACACACA CAATGGGACC AAGCGAACAA 2770
ACCTCCGAAC CAAGGATCAA GACACAAAGA ACGGATGGAA AGGAAAGAGA GGACAGCAGA 2830
GAGAGCCTC GATTACAGA AAGGGCGATT ACATTAT TAC AGAAATCTGG TGTAACCCAA 2890
TCTGCAGCAA ATTAGACCT ATACCAAGAC AAGAGATGG TTGTGTGTCG GAATCTCTA 2950
AACATCGAC ATACTCGCATC AAAGATAGAC TTCTCTAGCG TTGTGATGAT AGGAGTGTCA 3010
ATGGATCATG ATACCAAAAT AAATCAGATT CAGAACCGAGA TATTAAGTTT GAAAATGTAT 3070
CTTAAAAAGA TGGATGAATC ACATAGAAGA CTAATTGAGA ATCAAAAGA ACAATTATCA 3130
CTGATCACAT CATTAACTC AAATCTAAA ATTATGAGAC AGAGAGGAGG GAAGAGGAGC 3190
CAACCGAGAC CTAGCGGGAG GACATCCATG ATCAAGAACAA AAGCAGAAAGA AGAACAAATA 3250
AAGAAAAGTC GGTGTCGCCCC TCTTATGGAA ACACAGGCC CTGGAGAAAAA CATCCCTGAC 3310
CTCTATAGAT CAAATAGAGAA AACACCGAGA AACCGACACAG ATCAAAATC AGAAAATAC 3370
AGATTGAATG ATGAATCCAA TGCCACTAGA TTGATCTCTA GAAGAATAAG CAGTACAATG 3430
AGATCATTA TAATAATCAT TAACAAACAGC AATTATCAT CAAAAGCAA GCAATCATA 3490
ATCAACGAAAC TCAAGCTCTG CAAGACTGAC GAGGAAGTGT CTGAGTTGAT GGACATGTG 3550
AATGAGGATG TCAGCTCCAA GTAAACCGCC ACCAACAGGT CAACACAGA AAAACCAATA 3610
GCACAAAACA GCCAATCAGA GACCACCCCA ATACACCAA CAACTCAACA CATAAAAGG 3670
ATCTCCAGAT CATACTGATGAT TAAGAAAAC TTGAGATGAA AGGACTAATC AATCTCCGA 3730
AACATGAGC ATCACCAACT CCACAATCTA CACATCCCA GAATCTCTT TCTCCGAGAA 3790
TGGCAACATA GAGCGGTAC CACTCAAGGT CAATGAACAG AGAAAGGCCA TACCTCATAT 3850
TAGGGTTGTC AAGATAGGAG ATCCGCCAA ACATGGATCC AGATATCTGG ATGCTTTTTT 3910
ACTGGGGCTC TTGAGATGG AAAGGTCAAA AGACAGGATG GGAGGCTATAA GTGATCTAGA 3970
TGATGATCCA AGTTACAAAGG TTGATGGCTC TGGATCATTC CCACTGGGT TGGCTAGATA 4030
CACCGGAAT GATCAGAAC TCCCTACAGGC TGCAACCCAA CTGGATATAG AGAATAGGA 4090
AACTGTAAAG GCTACGGAGA TGATAGTTA CACTGTAAAC AACATCAAC CTTGAACTATA 4150
TCCATGGTCC AGTAGATTAA GAAAAGGGAT GTTATTTGAC GCTAATAAGG TTGCACTTGC 4210
TCCTCAATGT CTCCCACTAG ATAGAGGGAT AAAATTCAAGG TGATATTTG TGAACGTGAC 4270
AGCAATTGGA TCAATAACTC TATTCAAAAT CCCTAAAGTCC ATGGCATTTG TATCA TTGCC 4330
TAATACATA TCAATAAAATC TACAAGTACA TATCAAAACA GGAGTTGAGA CAGATTCCAA 4390
AGGAGTGTGTT CAGATTCTAG ATGAAAAAAGG TGAAAAAATCA CTAAATTCA TGTTTCTATC 4450
CGGGTTGATC AAAAGGAGAA TGGGCAGAAT GTACTCGGT GAATATTGTA AGCAGAAGAT 4510
CGAGAAAGATG AGATTATTAAT TCTCATGGG ATTAGTTGGA GGGATCAGCT TCCACGTCAA 4570
CGCAACTGGC TCTATATCAA AGACATTAGC AAGTCAAATTA GCATTCAAAA GAGAAATCTG 4630
CTATCCCCTA ATGGATCTGA ATCCACACCTT AAATTCAGTT ATATGGCCT CATCAGTTGA 4690
AATTACAAAGG 4700

FIGURE 2B



Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 10 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

GTAGATGCG AGTCAGGCC TTCTCCAGCC TTCAATTACCT GGCGAATTCA GATACTACCC AAACATCATA	4760
GCAAAAGGG TCGGGAAAAT CAGACAGTAA AACACACAC CCTGATATCC AACATTGCAA	4820
ATCAGGCTAC CCACAGGAG AAAATCAAA ACTTAGGATC AAAGGGATCA CCACGAACCC	4880
CGGAAACAG CCAACACAAAC AACACACAACT AACACAGACA AAAAGGAGAA GGCACTGCAA	4940
AGACCGAGAA AACACAGAAC GCACACACAA AAGCAGAGA AGCAGAACCG CCGCCATTCA	5000
CAAACACACC AACAAATCTG CAAACAGCA CCAAAACAGA GTTCAAAAAGA CAAAGAGCAC	5060
CAGATATGAC CATCACAAAC ACACATCATAG CCATATTACT AATACCCCCA TCATT TTGTC	5120
AAATAGACAT AACAAARACTG CAACGTGTAG TTGTTGTTAGT CAACATCTT AAAGGCATGA	5180
AGATTCACA AAATTCGAA ACAGAGATACC TGATATTAAAG TTGATACCC AAAATAGAGA	5240
ATTCAACACTC ATGTTGGGGT CAACAGATA ACCAATACAA GAAGTTATTG GATAGATTGA	5300
TAATTCTCT ATATGATGGA TTAAAATTAC AAAAGATGT AATAGTAGTA AGTCATGAAA	5360
CCCAACAAAC TACTAATCTT AGGACAAACAG GATTCTT TGG AGAGATAAT GGGACAATTG	5420
CGATAGGGAT AGCCACTCTA GCACAAATCA CGCGCAGCT CGCTCTGTG GAAGCTAAC	5480
AGGCAAGTC AGACATAGAA AAACCTCAAG AGGCTATAAG AGACACAAAC AAGGCAGTAC	5540
ATCGATTCA AAGTTCTGTA GGTAACCTAA TTGTTGCACTT AAATTCAGTT CAAAGCTATG	5600
TCAACATGA AATTATACCT TCACTCACAA GATTAGGCTG TGAAAGCAGCA GGGTTACAT	5660
TGGGAATTGC ATTGACACAA CATTACTCA GAAATACAAA TATATTGTTGATAATATAG	5720
GAACACTGAA AGAAAAGGG ATAAAATTAC AAGGGATAGC ATCATTATAT CACACAAACA	5780
TAACGGAAAT ATTTACTACT TCAACAGTTG ACCAATATGA TATTTATGAC CTATTATCA	5840
CTGAGTCAAT CAAGATGAGA GTGATAGATG TTGATTGAG TGATTACTCA ATTACTCTTC	5900
AAGTTAGACT TCCCTTTATA ACTAAACTAT CAAACTACCA AATTATATAA GTAGA TTCTA	5960
TATCATACAA CATCCAGGGC AAAGACTGT ATATCCCTCT TCCCAATCAC ATCATGCAA	6020
AAGGGCCTTT TCTAGTGTGTT GCTGATATTA AAGAATGCA AGAGGCATTC AGGAGTTATA	6080
TATGCTCTC TGATCCAGGT TACATATTA ATCAGGAGAT AGAGAATTGT TTATCAGGGA	6140
ACATAACACA GTGTCCTAAAG ACTGTTGTTA CATCAGATGT GGTACACAGA TAGCGTTTG	6200
TGAATGGTGG ATTAATGGCA AACTGCTATAA CAACTACATG TACATGCAAT GGAATTGACA	6260
ATAGAATTAA TCAATCACTT GATCAAGGAA TTAGATCAT AACACATATAA GAATGCCAGG	6320
TAATAGGTAT AAACGGAAATG TTATTCAATA CTAATAGAGA AGGGACATTA GCAACTTATA	6380
CATTGATGA CATCATATTA AATAACTCTG TTGCACTTAA TCCAATTGAT ATATCTATGG	6440
AACTCAACAA GGCAAACAACTA GAATTAGAG AATCGAAGGA ATGGATAAG AAATCAATC	6500
AAAAGTTAGA TTCCGTTGGA AGTTGGTATC AATCTAGTGC AACAAATCACC ATAATCATAG	6560
TGATGATAAT AATTCTAGT ATAATCAATA TAACAATTAT TGATGTCATA ATCAAATTC	6620
ATAGAATTCA GGGAAAGAT CAAACAGACA AAAACAGTGA GCGGTATATA CTGACAAATA	6680
GACAATAGA CTATACACGA TCAAAATATAA AAAGTACAAA AACTCTAGGA ACAAAAGTTGT	6740
TCAACACAGC AGCAGCCGAAT AGACCAAAGA CGACGGCAGA GGGGACACCA AACTCAAAA	6800
TGGAATATTG GAAACACACA AACAGCTATAA ATAACACCAA CAATGAAACC GAAACAGGCC	6860
GAGGCAAAACAGA TAGTAGCAAG GTTACAATAA TCATAATGTA CACCTTCTGG ACAATAACAT	6920
TAACAAATATT ATCAGTCATT TTTATAATGA TATTGACAAA CTTAATTCAA GAGAACAAATC	6980
ATAATAAATT AATGTTGCAG GAAATAAGAA AAGAATTCCG GGCACATAGAC ACCAAGATTC	7040
AGAGGACTTC	7050

FIGURE 2C



Docket No.: NIH-0127
Inventor: Mario H. Skidopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 11 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

GGATGACATT GGAACCTCAA TACAGTCAGG AATAAATACA AGACTTCTCA CAATT CAGAG 7110
TCATGTTCAA AACTATATCC CACTATCATT AACACAAACAA ATGTCAGATC TCAGAAAATT 7170
TATCAATGT CTAAACAAATA AAAGGAAACA TCGAGAATG CCAATACAGA GAATGACTA 7230
TGATGAGGGT ATAGAACCCC TAAATCCCAA CGAGTCTCTGG AGGTGTACAT CTGGTAACCC 7290
ATCTCTAACAA AGTAGTCTCA AGATAAGGGT AATACAGGA CCAGGTTTAT TAGCACACTC 7350
TACTACAGTA ATGGCTGTA TTAGAATTCC ATCGTTAGTA ATCAATCATC TAATCTATGC 7410
TTACACCTCT AATCTTATTA CCGAGGGCTG TCAAGATATA GGAAATCTT ACCAAAGTACT 7470
ACAAATAGGG ATAATTACTA TAAATTGGGA CCTAGTACCT GAITTAAACC CCAGAGTCAC 7530
ACATACATT AATATTGATG ATAATAGAAG ATCTTGCTCT CTGGCACTAT TGAATACAGA 7590
TGTTTATCG TTATGCTCAA CACCCAAAGT TGATGAAAAGA TCCGATTATG CATCACACAGG 7650
TATTGAGGAT ATTGTACTTG ACATGTGAC TAATAATGGA TTAAATTATAA CACAAAGGTT 7710
TACAAATAAT AATATAACTT TTGATAAACC GTATGCA GCA TTGTTATCCAT CAGTGGGAC 7770
AGGAATCTT TATAAGGATA AAGTTATATT TCTCGGATAT GGAGGGCTAG AGCATGAAGA 7830
AAACGGAGAC GTAATATGTA ATAACATGG TTGTCCTGG AAAACACAGA GAGACTGTAA 7890
TCAGGGCTCT TATAGGCCAT GTTCTCAA TAAAGGATG TGAATCTA TTATTGTTG 7950
TGATAAAAGG CTAAGATGCAA CTTTTAGCTT GAGGGGTGG ACTATTCCAA TGAGCCAAAAA 8010
TTATTTGGGA TCAGAAGGAA GATTACTTTT ATTAGGTGAC AGAATATAAC TATATACTAG 8070
ATCCACAGT TGGCACAGTA AATTACAGTT AGGGGTAATT GATATTCTG ATTACTACTAA 8130
TATAAGAATA AATTGGACTT GGCATAATGT ACTATCACGG CCAGGGAATG ATGAATGTCC 8190
ATGGGGTCAT TCATGCCAG ACGGATGTAT AACAGGAGTT TACACTGATG CATATCCGCT 8250
AAACCCATCG GGGAGTTG TATCATCAGT AATTCTTGTAT TCACAAAAGT CTAGAGAAAAA 8310
CCCAATCATT ACTTACTCTAA CAGCTACAAA TAGAATAATTA GAATTAGCTA TATATAACAG 8370
AACACTTCCA SGTGCATATAA CAACACAAA TTGTTATCATA CATTATGATA AAGGGTATTG 8430
TTTTCATATA GTAGAAATAA ATCACAGAG TTGTAATAGC TTTCACCTA TGTTATTCAA 8490
AACAGAAGTT CCAAAAGTAC CGACGTTAAT TGATCATCGC ATATCCGATG CAAGATGACA 8550
TTAAAAGAGA CACCCAGAC GACAACACAG GAGACGATGC AAGATATAAA GAATAATAAA 8610
AAAATCTAGG AGAAAAGTGT CCAAGAAAAA TGACACCGA GTCCACACAG GGCACACAT 8670
CTGACATTCT GTACCTGAA TGTCACTCTA ATTCTCTAT AGTTAAAGGA AAGATAGCAG 8730
AACTGCATAC AATAATGAGT TTGCTCTCAGC CCTACGATAT GGATGATGAT TCAATACTGA 8790
TTATTACTAG ACAAAATATT AAACTCAATA AATTAGATAA AAGACAAACGG TCAATTAGGA 8850
AATTAAGATC AGTCTTAATG GAAAGACTAA GTGATCTAGG TAAATATACC TTATCATGAT 8910
ATCCAGAGAT GTCTAGTGAA ATGTTCCAT TATGATACCC CGGAATTTAAT AATAAAATAA 8970
ATGAATTGCT AGTAAAGCA AGTAAAACAT ATAACTAAAT GACTGTGGA TTAGAGATC 9030
TATGGGTTAC TATACATCG AAGTTAGCAT CGAAAAATGGA TGAAGTAAT TATGATATCA 9090
ATGAAGATAT TAGCAATATC TCAATGTTC ACATGACTTA TCAATCAGAC AAATGGTATA 9150
ATCCATTCAA GACATGGTTT ACTTAAAGT ATGACATGAG AAGATTACAA AAAGCCAAA 9210
ATGAGATTAC ATTCATAGG CATAAAGATT ATAATCTTATT AGAAGACCAA AAGAATATAT 9270
TGCTGTACAA TCCAGAACTC GTCTTAATAT TAGATAACAA AATTTACAAT GGGTTATATAA 9330
TGACTCCCTGA ATTGGTACTA ATGTTATTGTG ATGTTAGTTGA AGGGAGGGTGG AATATAAGTT 9390
CATGTGCAA 9400

FIGURE 2D



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 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 12 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

ATGGATCCT AAGTTACAAT CAATGTATTAA TAAAGGGTAAAC AATTTATGGG AAAATAATAGA	9460
TGGCATATTC TCACCCCTAG GAGAAAAGAAC ATTGACATAA ATATCACTAT TAGAACCACT	9520
TGCATTCTCG CTCAATTCAA CCTATGACCC GGTAAACAG CTCAGGGGGG CTTTTTAA	9580
TCACGGTTA TCAGAAATTG AATAATTATT TGCACTGTAG TGACAAACAG AGGAAATACC	9640
TAATGTGGAT TATATAGATA AAATTTAGA TGTTCTAA GAATCAACAA TAGATGAAT	9700
AGCAGAAATT TTCTCTCTC TCCGAACTTT TGACACCCCT CCATTAGAGG CGAGTATAGC	9760
AGCAGAGAAA GTTAGAAGT ATATGTATAC TGAGAAATGC TTGAATTTG ATACTATCAA	9820
TAATATGTCA TCTATTTTTT GTACAATAAT TATAATGGA TATAGAGAAA GACATGGTGG	9880
TCAATGGCC CCGATTACAT TACCTGTCCA TGACACATGAA TTATCATAA ATGCA TACGG	9940
ATCAATTCTC GGCATATCAT ATGAGAATGC TGAGATTAT TATAAGAGCT TCATAGGAT	10000
AAAATTTGAC AAGTTTACG AGGCTCAATT GGATGAGAC TTAACTATT ATATGAAGA	10060
TAAGGATTA TCCCTAAAGA ATACAACTTG GGACACAGTC TATCCAGCTT CAAACCTGTT	10120
ATACCGCACT AATGTGTC C ATGATTCAGG AACATTGTT GAAGTATTAA TAGCAGATAG	10180
TAATATGTGAT CCCCACCAAG TATTAGATTA CGTAACTCA GGATATTGGG TGGATGATCC	10240
TGAATTTAAT ATCTCATATA GTTTAAAGA GAAAGAAATA AAACAGAAG GTAGACTTTT	10300
TGCAAAAATG ACATACAAGA TGAGGGCTAC ACAAGTATTAA TCAGAACAT TATTGGGAA	10360
TAATATAGGG AAATTCCTCC AAGAGAATGG GATGGTTAA GGAGAAATTG AATTACTCAA	10420
GAGACTAAC AACAATCTCA TGCTCTGGAGT TCCGGGGTAT AATGAGGTT ACAAATAATC	10480
AAAAGTTCAC ACAGAAAGAC TCTAACGTTA TAATGACATT AGCAGTTCCA ATTATTCCT	10540
TAATCAGAAG TCAAAGAAGT TTGATTAAATC ATACAGAT ATATACAATG ATGGA TACGA	10600
AACCGTAAGC TGCTCTCAA CGACAGATCT TAAAAAAATAT TGTTAAATT GGAGGTATGA	10660
ATCAACAGCT TTATTCGGTG ATACTTGAA TCAGATATT GGTTAAAGG AATTATTTAA	10720
TTGGCTGCAC CCTCGCCCTG AAAAGAGTAC AATATATGTT GGAGATCCTT ATTGCCGCC	10780
ATCAGATATT GAACATTAC CACTGTGTA CCATCCTGAT TCAGGATTTT ATGTTCATAA	10840
TCCTAAAGGA GGAATAGAAG GGTTTTGCCA AAAGTTATGG ACACCTATAT CTATCAGTGC	10900
AAATACATTCA GCACGCTGCA AAATCGGGTGT AAAGAGTACT GCATGGTTT AAGGGATAAA	10960
TCAAGGCCA GCTGTTTACCA CAAGAGTACC TAATATTAT GATTATAAGG TTAAAGAAGA	11020
GATTGTTTAT AAGAGTGTG TGAGATTTT TGATCCCTTG AGAGAGGTGA TGGATGATCT	11080
GGGGTCATGAG CTCAAACATAA ATGAAACTAT AATAGTGTG AAATGTTTA TATATAGCAA	11140
AAGGATATAC TATGACGGAA GAATCCTTCC TCAGGCTTA AAAGCATTGT CTAGATGTGT	11200
TTTTGGTCT GAAACAATCA TAGATGAGAC AAAGATCAGCA TCCTCAAATC TGGCTACATC	11260
GTTTGCAAG GCCATTGAGA ATGGCTACTC ACCTGTATTG GGATATGTAT GCTCAATCTT	11320
CAAAATATC CAACAGTTGT ATATAGCGT TGGAATGAAT ATAAACCCAA CTATAACCCA	11380
AAATATTTAA GATCAATTATC TCAGGAAAT TCATTGGATG CAATATGCTT CCTTAATCCC	11440
TGCTAGTGTGTC GGAGGATTTA ATTATATGGC CATGTCAGG TGTTTTGTCA GAAACATTGG	11500
AGATCCTACA GTGCGTGGGT TAGCCGATAT TAAAGATTAT AAAAAAGCAA ATTTGTTAGA	11560
TGCGAGGTGTC CTTTACAGAA TTATGAATCA AGAAGCAAGG GAGTCTCTT TTTTAGACTG	11620
GGCCTCGAGAT CCCTTATCATC GTAATCTCAA AATATAACCA CCATGATAAA	11680
GAATATAACT GCAAGAAATG TACTACAGGA CTCACCAAAC CCATTACTAT CTGGATTATT	11740
TACAAGTACA	11750

FIGURE 2E



Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al. **00000000000000000000000000000000**
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 13 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

ATGATAGAAG AGGATGAGGA ATTAGCTGAG TTCTCTAA TGG ACAGGAGAAT AATCCCTCCCA 11850
AGAGTTGCAC ATGACATTT AGATAATTCT CTTACTGGAA TTAGGAATGC TATAGCTGGT 11870
ATGTTGGATA CAACAAAATC ACTIAATTGCA GTAGGGATAA GCAGAGGAGG ATTAACCTAT 11930
AACTTATTAA GAAGATAAG CAACTATGAT CTGTACCAT ATGAGACACT TAGTAAAACT 11990
TTAACGACTAA TAGTCAGTGA CAAGATTAQ TATGAGATAA TGTGCTCACT AGACCTAGCC 12050
ATATCATTAA GACAAAAAT GTGGATGCT ATATCAGGAG GAAGAATGAT AAATGACTT 12110
GAAGACTCCAG ATCTCTTAAAG GTTACTGTCT GGAGTATAAA TAACAGGATC TGACACATGT 12170
AGGATATGTT ATTCACATGAG AGGTGAAAGC CCATATACAT GGATGTATT ACCAGGCAAT 12230
CTTAATATAG GATCAGCTGA GACAGGAAATA GCATCATTA GGGTCCTTA CTTTGATCA 12290
GTTACAGATG AGAGATCTGA AGCACAATTA GGGTATATCA AAAATCTAAG CAAACAGCT 12350
AAGGCTGCTA TAAAGATGAA ATGATATAT ACTTGGCAT TTGGAAATGA CGAACATATCT 12410
TGGATGGAG CATCACAGAT TGCACAAACAG CGTCGAAACT TTACATGGG TAGCTTAAAG 12470
ATTTTGACAC CAGTGCACAC ATCACAAATAT CTATCACCA GGTTAAAGA TACTGCTACT 12530
CAGATGAAAT TTCTTAGTAC ATCACTTATT AGAGTAAGCA GTTTCATCAC AATATCTAAT 12590
GATAATATGT CTATTAAGA AGCAAATGAA ACTAAAGATA CAAATCTTAT TTATCACAG 12650
GTAATGTTAA CAGGATTAAG TGTATTGAA TATCTTATTA GTGGAGGAG GAGTAAGGAA 12710
CTAAACCTTA TTGGTCATGCA TCTACATATA GAGGGATGGT GTGTATAAA AGAGA GTTAC 12770
AATGATGAGC ATATACTAACCG GGAGTCTACA TTAGAGTTAA TCAAAATCCC TGAGAGTAAT 12830
GAATTTTAT ATGATAAGGA CCCCCCTTAAG GATAGATGAT TATCAAAATT AATGGTTATA 12890
AGAGATCATT CTTATACAT TGACATGAA TACTGGATG ACACAGATAT TGTCATGCA 12950
ATATCAATAT GTACTGCACT TACATAGCA GATAACATGT CGCAGCTAGA TCGGGATAAT 13010
CTTAAGGAGC TTGGTTGTAT TGCAAAATGAT GATGATTTA ACAGTCTGAT AACTGAAATT 13070
CTGACCCCTAA ATATACTAGT GTTCTCAAA ACATTTGGAC GTTACTCTGT GAATCAATT 13130
GCATATACCC TTATGGATT GAAATAGAA GGAAGGGATC CCATTGGGA TTATAATATG 13190
AGAACATTAA AGAACACCTC ACATTCAGTA CTAAAAGTAT TATCTAATGC ATATCTCAT 13250
CCAAAAGTGT TTAAGAGATT TTGGGATTGT GGAGTTTGA ATCCATTATTA TTGGCTAAAT 13310
ACTGCTAGTC AAGATCAAGT TAAGCTTGCT CTCTCGATT GCGAGTACTC CTGGATCTA 13370
TTATGAGAG AATGGTGAAG TTGGACATCA CTTGAGATCT ATATCTGTGAG TGTGACATG 13430
GAAATAGCAA ATGACAGAAAC CAACGATTCA CTCTCAAGAC ATCTTGGCTT TTGTGTTGT 13490
TACAGAGAGA TACCATCTTT TTGGACAAAT TTATTAATC TACATATCT AGAGA GACTT 13550
GATGAATTAA AACAAATCTT AGATCTGAAC ATCAAAAGG ATCCTACTCT TAATATATGT 13610
CAAGTATCAG GACTGTATAA TAATCATTC CCCCCTCACTG TTACGTATGT AAGGAAAACCT 13670
GCGGATTAAGT ATCTGGAGAT CGCTGGTATT AATCCGCTG AAACGATTGA AGATTGGGAT 13730
CCCATAGAAG ATGAGAAATAT CTTAGACAAAT ATTTGTTAAA CTGTTAAATGA CAATTGCACT 13790
GATAATCAAAG AGGAAATAAA AACTGTTAT TTCTGGGAT TAGCTCTAA GAATTATCAA 13850
GTCTGGAAAGA TAAGATCCAT AACGGAGTGT CTGTGAGTTA ATGAAGCTTC GAATGTTACT 13910
ACACATGGAA TGACACTTC TCAGGGAGGA AGTTATCTAT CACATCAGCT GAGGTATT 13970
GGAGTAAACAA GTACAAAGTGT TTCTTAAAGCTT CTGGATATGAA CAAACATTT AATGGGGAA 14030
GTAAAAAAAG ATAAGATGAA ACTCTTTTA GGAGAGGAGG CAGGGCTAT GTTAGCATGT 14090
TATGATGCTA 14100

FIGURE 2F



Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 14 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

SEQ ID NO: 36

CACTGGTCC TCGAATAAT TATTATAATT CTGGTTAAA TATTACAGAT GTAA TGGTC	14160
AACGGGAATT AAAATCTTC CCATCAGAG TATCATTAGT AGGTAAAAAA CTAGGAATG	14220
TAACACAGAT TCTTAAATCGG GTGAGGGTGT TATTAAATGG GAATCCCAAT TCACCATGGA	14280
TAGGAATAT GGAATGTGAG AGTTAATAT GGAGTGATT AAATGATAAG TCAATTGGTT	14340
TAGTACATTG TGACATGGAG GGAGCGATAG GCAAATCAGA AGAAAATGTT CTACATGAAAC	14400
ATTATAGTAT TATTAGGATT ACATATTTA CGGGGATGTA TGATGTTGTC CTAGTATCAA	14460
AAATTATACC AACTTAACT CGGAATTGGT CTAATTAATCT CTATCTATAC AAGTTGTATT	14520
GGAGGGATGT AAAGTGTAGTG CCTCCCTAAAAA CATCCAACTTC TGCCCTAACACA GAGCTTTATT	14580
TAATTTCAAA AGATGCTTAC TGTACTGTAA TGGAACCCAG TAATCTTGT TTATCAAAC	14640
TTAAAAGGAT ATCATCAATA GAAGAAAATA ATCTTAAATGGTAAATAC TTATCAAAC	14700
GGAAAGATAA CGAGTGGTTA CAGCATGAA CTAAAAGGAG AGAAAGGGT TATGGATAA	14760
TGAGGCCATA TCTACAGCA CTGCAAATT TTGGATTCCA AATTAACCTTA AATCACTTAG	14820
CTAGAGAAATT TTATCACCTT CTCGATTAA CCAACATTA TAATATAATT CAAAGTTTA	14880
CAAGACAAAT TAAAGATGTT ATGTCGAAT GGGTCAAAT TCACTCATGAC AAAAAAGAC	14940
ATAAATTAGG AGGAAGATAT AATCTTATCC CGCTTAAAAA TAAGGGAAA TTAAGATTAT	15000
TATCACGAG ATTAGTACTA AGCTGGATAT CATTATCCTT ATCAACCCAGA TTACTGACGG	15060
GCGTTTCCC AGATGAAAAA TTGAAAATA GGGCACAGAC CGGATATGTA TCATTGGCTG	15120
ATATTGATTAA AGAATCCCTA AGTTTATTAT CAAGAAATAAT TGTCAAAAT TACAAAGAAC	15180
ACATAGGATT AATATCCTAC TGGTTTTGA CCAAGAGGT CAAAATACTA ATGAAGCTTA	15240
TAGGAGGAGT CAAACTACTA GGAACTCTTA AACAGTACAA AGAGTTAG GATGGATCAT	15300
CTCAGGGTTA TGAATATGAT AATGAATTG ATATTGATTA ATACATAAAA ACATAAAAATA	15360
AAACACCTAT TCTCACCCA TTCACTTCCA ACAAAATGAA AAGTAAGAAA AACATGTAAAT	15420
ATATATATAC CAAACAGAGT TTTCTCTTG TTTGGT	15456

FIGURE 2G



Docket No.: NIH-027
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 15 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

FIG. 3A

Mutagenesis to create restriction sites of start and stop codons of N

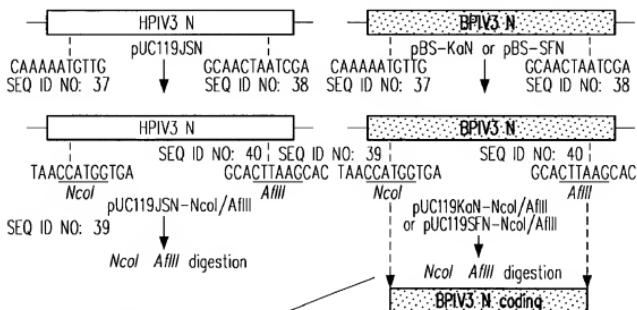


FIG. 3B

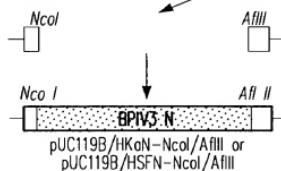
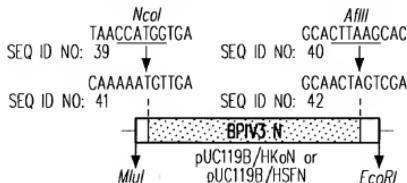


FIG. 3C

Mutagenesis to restore start and stop codon context



LEGEND

- [Shaded box] BPIV3 sequence
- [White box] HPIV3 sequence



Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 16 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

FIG. 4A

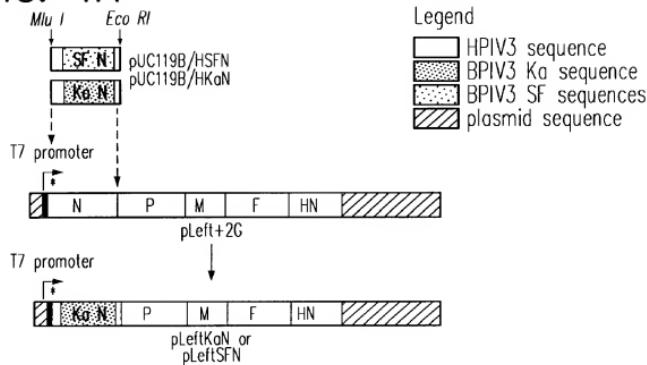
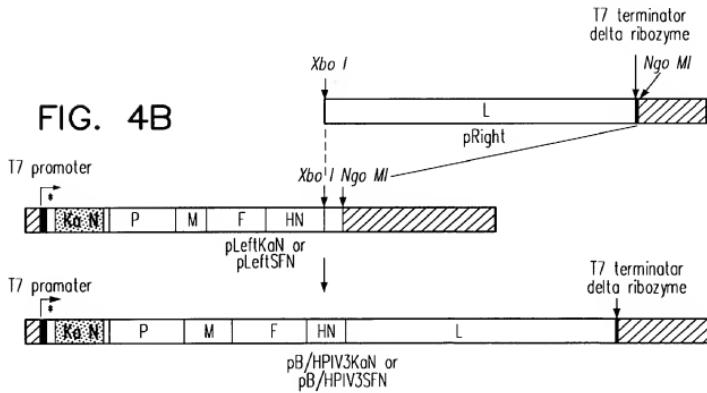


FIG. 4B





Docket No.: NIH-0127
 Inventor: Mario H. Skiadopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 17 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

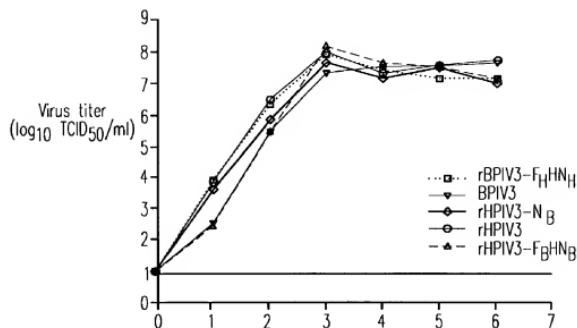
FIG. 5A

SEQ ID NO: 43	rJS	GGAACCTATAATTCAAAAAATGGAGCCTATTGATAC
SEQ ID NO: 44	cKo	GGAACCTATAATTCAAAAATGGACTCTATTGACAC
SEQ ID NO: 45	cSF	GGAACCTATAATTCAAAAAATGGACTCTATTGACAC
SEQ ID NO: 46	Ko	GAAATCTTAAGACTGTAATCATGTTGACTCTATTGACAC
SEQ ID NO: 47	SF	GAAATCTTAAGACTGTAATCATGTTGACTCTATTGACAC

FIG. 5B

SEQ ID NO: 48	rJS	TTAACGCATTGGAAAGCAACTIAATCGAATCACATTAA
SEQ ID NO: 49	cKo	TCACTCCATTGGAAAGCAACTAGTCGAATCAACATTTAA
SEQ ID NO: 50	cSF	TCACTCCATTGGAAAGCAACTAGTCGAATCAACATTTAA
SEQ ID NO: 51	Ko	TCACTGCATTGGAAAGCAACTAGTCACAAAGAGATGACCA
SEQ ID NO: 52	SF	TCACTCCATTGGAAAGCAACTAGTCACAAAGAGATGACCA

FIG. 13



JC-965 U.S. PTO
10/15/02

Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARA-INFLUENZA VIRUS (PIV)
VACCINES Page 18 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

Confirmation of identity of potential BPIV3/HPIV3 chimeras by TaqI digestion

Figure 6A

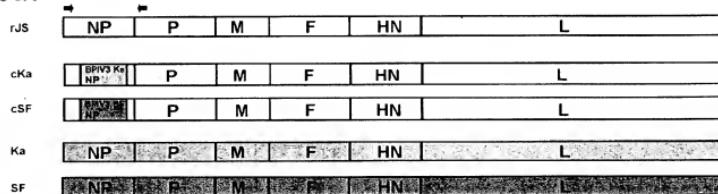


Figure 6B

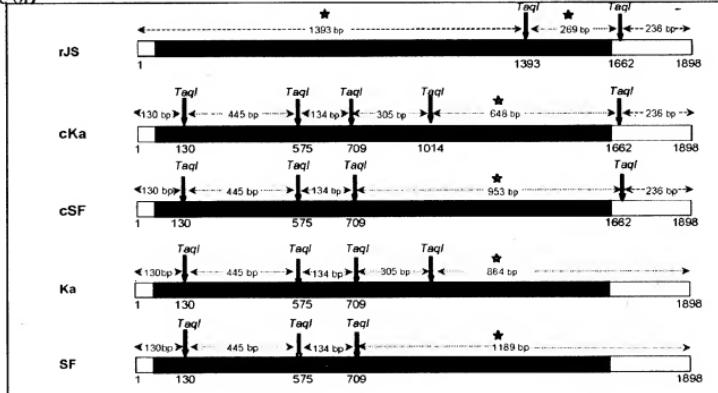
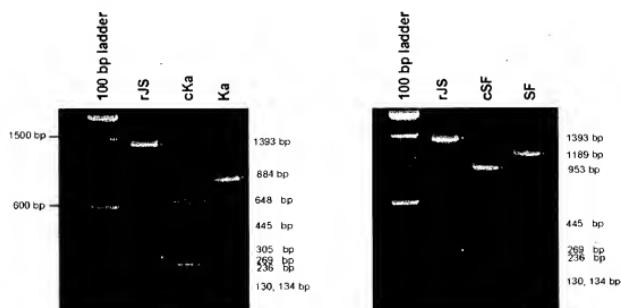


Figure 6C





Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 19 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

FIG. 7A

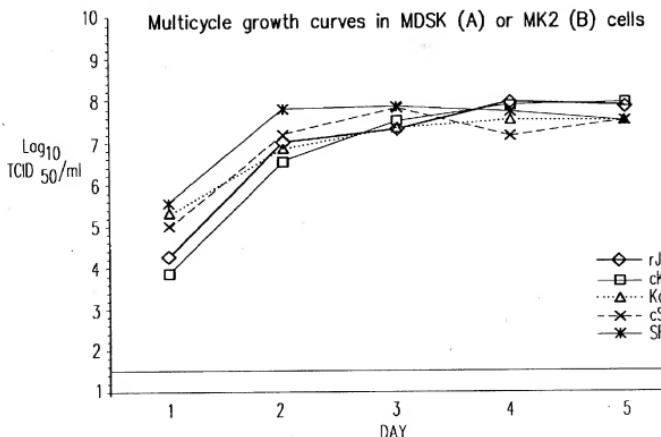
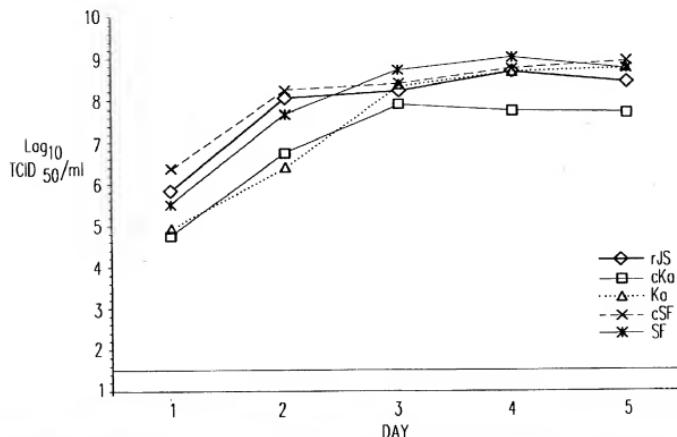


FIG. 7B





Docket No.: NIH-0127
 Inventor: Mario H Skladopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 20 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

00000112-101502

FIG. 8A

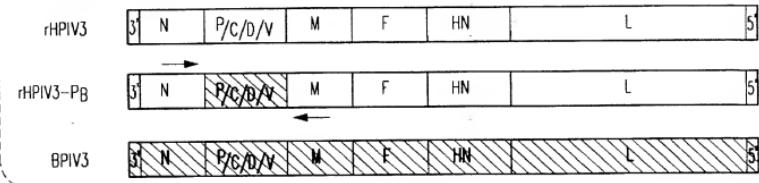


FIG. 8B

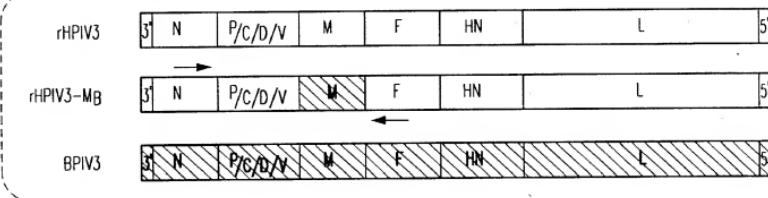
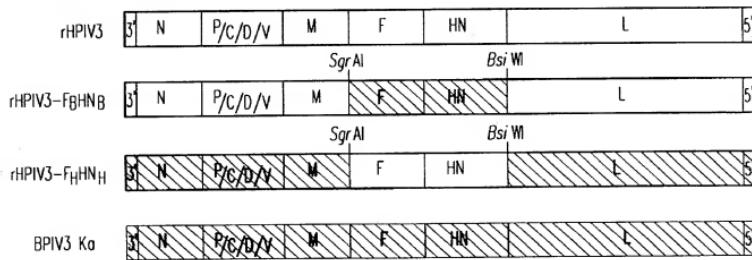
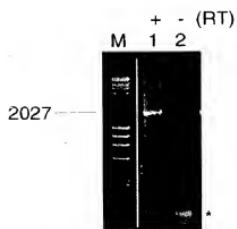


FIG. 11A



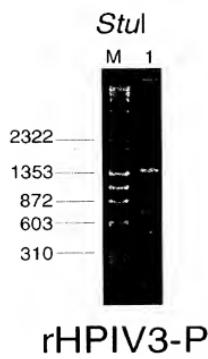
20/5/01
JCS
DRAFT

Figure 9A



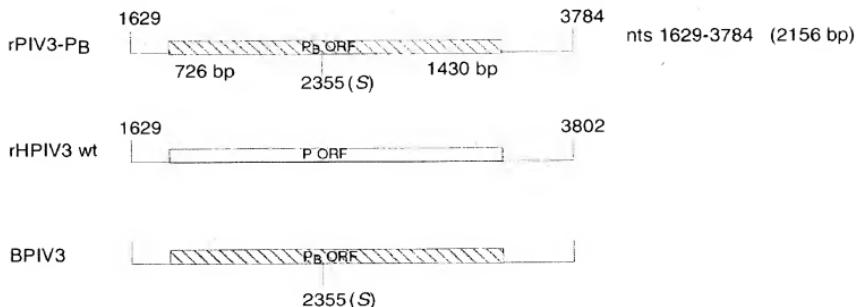
rHPIV3-PB

Figure 9B



rHPIV3-PB

Figure 9C



Docket No.: NIH-0127 Inventor: Mario H. Skidopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 22 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

jc965 U.S. PTO
10/15/02

Figure 10A

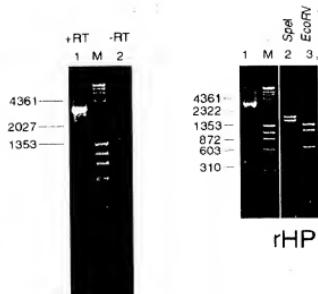
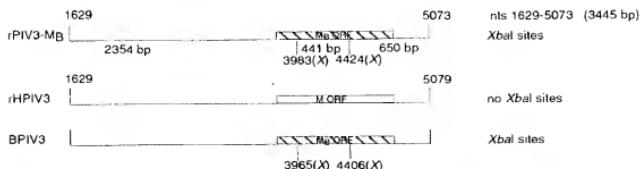
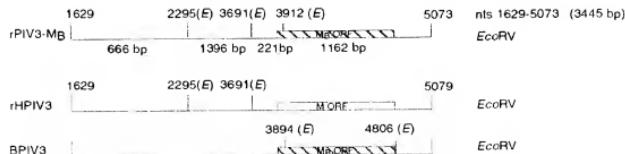
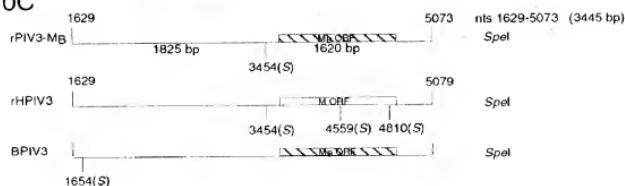


Figure 10B



rHPIV3-MB

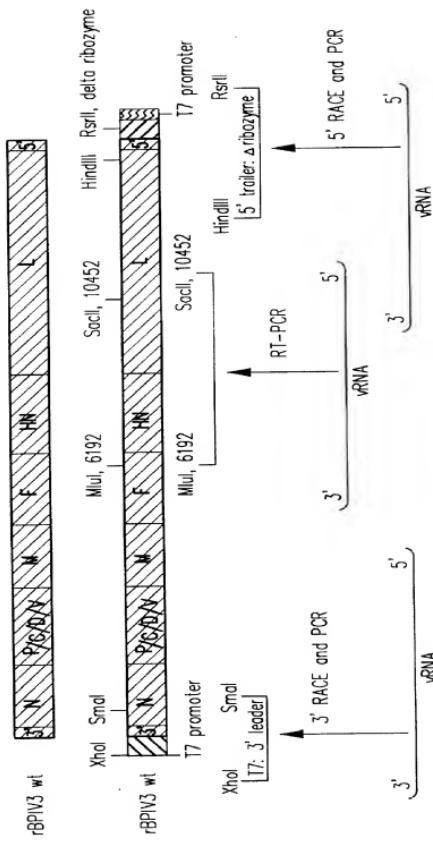
Figure 10C



SCANNED

FIG. 11B

Assembly of an antigenomic cDNA for BPV3 Ka



Sample No.: 09/900_112 Filming Date: July 5, 2001
CHIMERIC PARVULARILNEZNA VIRUS (PIV)
VACCINES Page 23 of 27
TRIPLE ALTERNATING HUMAN-BOVINE
SHEDOPOLIOS &
Docket No.: NIH-0127
Inventor: Minoh Shadopoliou





Docket No.: NIH-0127
 Inventor: Mario H. Skladopoulos et al.
 Title: ATTENUATED HUMAN-BOVINE
 CHIMERIC PARAINFLUENZA VIRUS (PIV)
 VACCINES Page 24 of 27
 Serial No.: 09/900,112 Filing Date: July 5, 2001

FIG. 11C Generation of full length cDNA clones encoding rHPV3/rBPV3 antigenic chimeric viruses

Generation of HPV3 and BPV3 full length clones

	N	P/C/D/N	M	F	HN	L
rHPV3 JS						

CGGACCTATCTA TAGACAAAAGGC
SEQ ID NO: 29 SEQ ID NO: 53
4832 8597

	N	P/C/D/N	M	F	HN	L
rBPV3 Ko						

TCCAAACATGCC AACATATAACA
SEQ ID NO: 27 SEQ ID NO: 57
4808 8591

Mutogenesis to create unique SgrAI and SIIW restriction sites

	N	P/C/D/N	M	F	HN	L
rHPV3 JS						

CGAACCGGTGA TAGACCTATCCGG
SEQ ID NO: 30 SEQ ID NO: 55
4832 8597

	N	P/C/D/N	M	F	HN	L
rBPV3						

TCCACCGGTCCA AAGACCTACCGA
SEQ ID NO: 28 SEQ ID NO: 56
4808 8591

3. Cloning of the F and HN genes into the heterologous full length cDNA

	N	P/C/D/N	M	F	HN	L
rHPV3 F/HN9						

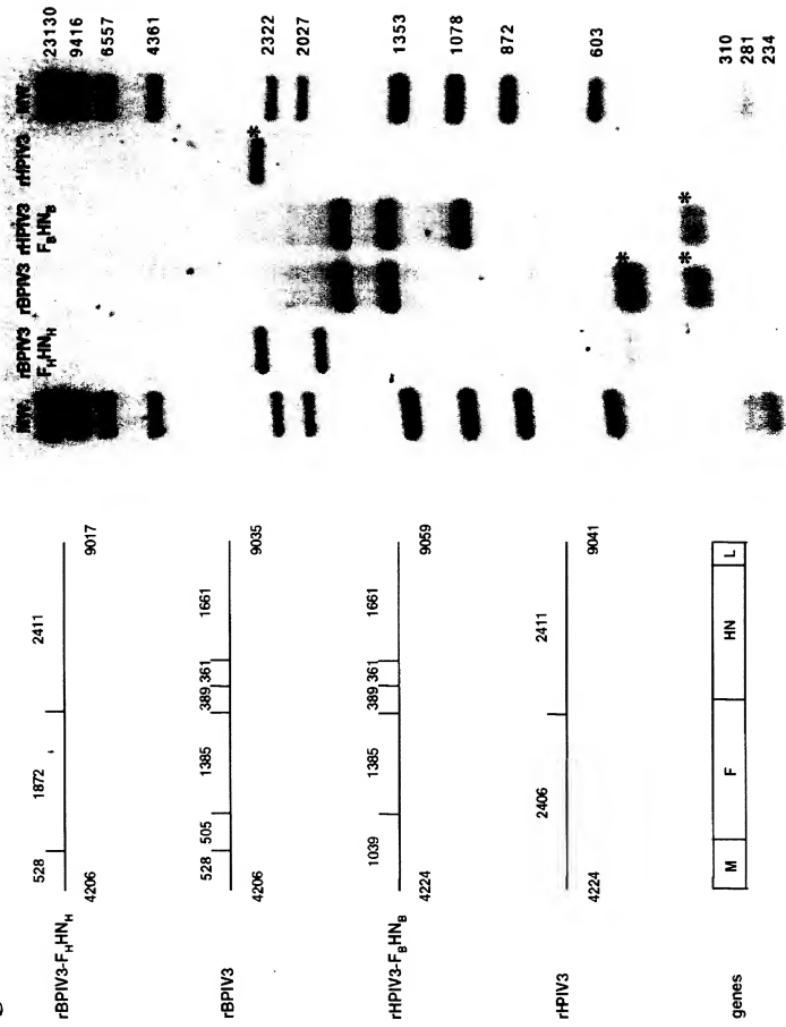
CSCACCCSTGCA AGACATACCGC
SEQ ID NO: 57 SEQ ID NO: 58
4832 8615

	N	P/C/D/N	M	F	HN	L
rHPV3 F/HN9						

TCCACCCGTA TAGACCTACCGA
SEQ ID NO: 59 SEQ ID NO: 60
4808 8973

SCANNED #

Figure 12



Sample No.: NIH-O127
Docket No.: NIH-O127
Leverette Method II Serologic Panels et al.
THE ALTERNATIVE HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (GPIV)
VACCINES Page 25 of 27
Serial No.: 09/000112 Filing Date: July 5, 2001

genes

M	F	HN	L
2406	2411	9041	603





Docket No.: NIH 0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 26 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

FIG. 14A

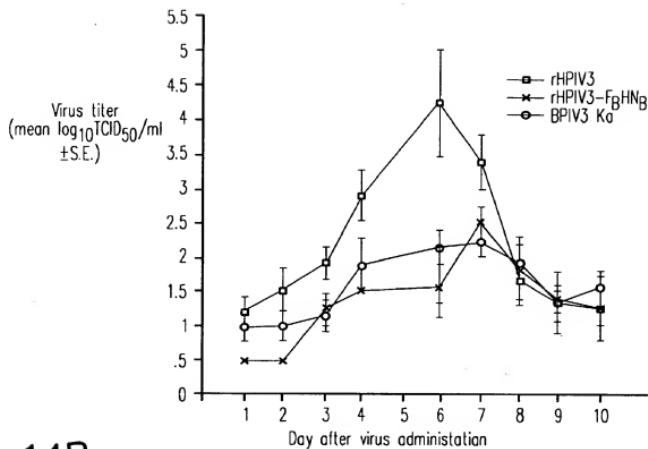
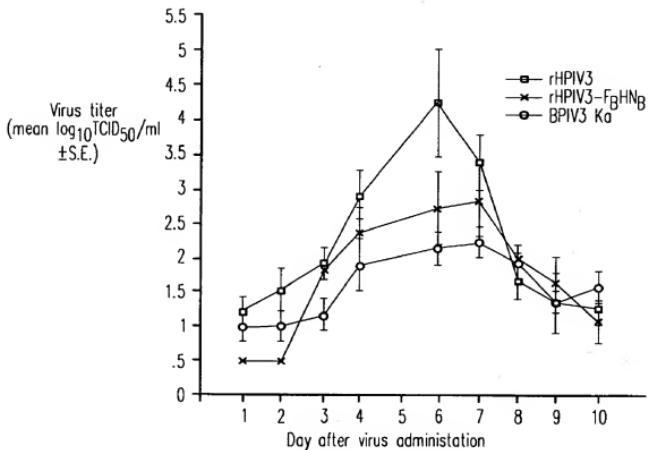


FIG. 14B





Docket No.: NIH-0127
Inventor: Mario H. Skiadopoulos et al.
Title: ATTENUATED HUMAN-BOVINE
CHIMERIC PARAINFLUENZA VIRUS (PIV)
VACCINES Page 27 of 27
Serial No.: 09/900,112 Filing Date: July 5, 2001

FIG. 15

rHPIV3	5'	N	P/C/D/V	M	F	HN		L	5'
rHPIV3 LB	5'	N	P/C/D/V	M	F	HN		LB	5'
rBPIV3 Kansas	5'	N	P/C/D/V	M	F	HN		LB	5'

FIG. 16

L START

SEQ ID NO: 61 rHPIV3 WT 8623 5' TAGGAGCAAAACCGTGCTCGGAAATGGACACTGAACTTAACA 3' 8664
SEQ ID NO: 62 rHPIV3 LB 8623 5' TAGGAGCAAAACCGTGCTCCGGAAATGGCACACCGAGTCCCACA 3' 8664
SEQ ID NO: 63 rBPIV3 wt 8617 5' TAGGAGAAAAGTGCAAGAAAAATGGCACACCGAGTCCCACA 3' 8658

L STOP

SEQ ID NO: 64 rHPIV3 WT 15325 5' ATGATGAATTTCATATCCATAAAACATAAATACAATGAAGA 3' 15366
SEQ ID NO: 65 rHPIV3 Lb 15325 5' ATAATGAATTTCATATGATTAATACCTACCAATGAAGA 3' 15366
SEQ ID NO: 66 rBPIV3 wt 15319 5' ATAATGAATTTCATATGATTAATACATAAAAACATAAAAATA 3' 15360